

Remarks

Reconsideration of this Application is respectfully requested.

Upon entry of the foregoing amendment, claims 1-11 and 13-36 are pending in the application, with claims 1, 35 and 36 being the independent claims. Claims 1, 35 and 36 have been amended. The amendment is believed to introduce no new matter, and its entry is respectfully requested.

Claims 1, 2, 29, 31 and 32 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Japanese Patent No. 07-002501 to Hisashi *et al.* (hereinafter “JP ‘501”) in light of U.S. Patent No. 6,007,785 to Liou (hereinafter “Liou”). Claim 3 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over JP ‘501 in light of Liou in view of U.S. Patent No. 4,954,320 to Birmingham *et al.* (hereinafter “Birmingham”). Claims 4-10, 26-28, 33 and 34 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over JP ‘501 in light of Liou. Claims 4-10 and 13-25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over JP ‘501 in light of Liou in view of U.S. Patent No. 6,024,930 to Racca *et al.* (hereinafter “Racca”). Claims 11, 30 and 35 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over JP ‘501 in light of Liou in view of U.S. Patent No. 3,967,131 to Slipiec *et al.* (hereinafter “Slipiec”). Claim 36 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over JP ‘501 in light of Liou in view of U.S. Patent No. 5,955,038 to Gadow *et al.* (hereinafter “Gadow”).

Based on the above Amendment and the following Remarks, Applicant respectfully requests that the Examiner reconsider all outstanding objections and rejections and they be withdrawn.

I. Claims 1, 2, 4-10, 26-29 and 31-34 Are Patentable Over JP ‘501 in Light of Liou

Claims 1, 2, 29, 31 and 32 stand rejected under 35 U.S.C. § 102(b) as being anticipated by JP ‘501 in light of Liou. Claims 4-10, 26-28, 33 and 34 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over JP ‘501 in light of Liou. For the following reasons, these rejections are respectfully traversed.

Claim 1 recites “a dielectric spaced apart from [a] conductor . . . wherein said dielectric and said conductor are positioned to create a turbulent air flow therebetween, and said cell is configured for stacking with another substantially similar dielectric discharge plasma cell.”

JP '501 fails to disclose or even fairly suggest the invention as recited by claim 1. Rather, JP '501 discloses an ozonizer for treating materials such as water, food waste and human waste flowing through a pipe (*see* ¶¶ 0001-02). The apparatus of JP '501 is formed by using two circular electrodes 1, 2 (*see* drawing 1) connected to a high-voltage source to form a narrow opening 3 along the outer wall of the pipe (*see* drawing 1). When a voltage is applied to the electrodes, the difference in charge causes a chemical reaction to occur with the raw materials that decontaminates the materials as they pass through the opening in the pipe (*see* ¶¶ 0002-03). JP '501 does not mention or even suggest that the flow of material through the opening 3 may be turbulent. Further, as discussed in detail below, achieving turbulent flow inside of the opening 3 is not desirable in the invention disclosed by JP '501.

When viscous substances (such as the types of substances treated in the pipe disclosed by JP '501) pass through a pipe, their flow is laminar. Laminar flow is a smooth flow with the velocity of the material varying from zero at the walls to a maximum along the centerline. As pressure differences force material to move along the length of a narrow pipe, a layer of molecules in the material “attaches” to the walls of the pipe. This “attachment” creates a predictable, structured velocity profile of the material as it flows through the pipe.

On the other hand, when a substance (such as air) flows freely at atmospheric pressure inside of a large opening, there is little structure due to the large volume of space with which the substance has to move. Both the lack of pressure “forcing” the movement of the substance through a narrow opening and the lack of surface to which molecules of the substance may “attach” relative to the volume of the space results in a turbulent flow.

In the dielectric barrier discharge plasma cell of the present invention, the spacing of the conductor and the dielectric is such that it enables the cell to treat a large volume of air in a room inside of a building. The cell is operable at atmospheric pressure and at room temperature. As such, air moving through the cell is not air that is “forced” through a narrow opening but is air contained inside of an open space with which there is room for the molecules to move in any direction. Additionally, there is a relative lack of surface area to which the molecules of the air may attach (as discussed above). Therefore, the flow of air through the cell is turbulent and not laminar as with air moving through pipes.

The turbulent flow of air through the plasma cell recited in claim 1 results in a faster and more efficient neutralization of a larger volume of material than the invention disclosed in JP '501. The structure of JP '501 does not allow the flow of material through the pipe to be turbulent because of the inherent pressure differences at opposite ends of the narrow pipe and the lack of space within which the material has to move relative to the surface area to which the material may "attach" (as discussed above).

Additionally, JP '501 is only directed towards the decontamination of contained hazardous waste. In contrast, the present invention is directed towards the neutralization of air inside of a building. Using a pipe (as disclosed by JP '501) for decontaminating an entire room is not desirable as it would simply not be effective because a large amount of time would be required to pump all of the air inside of the room through the pipe. Even if the air were to be pumped through a pipe, it would be difficult to keep contaminated air separate from already-decontaminated air. As such, a plasma cell that may decontaminate a large volume of air simultaneously is desirable. The present invention as recited by claim 1 achieves this desired result due to turbulence in the flow of air passing between the conductor and the dielectric.

Finally, JP '501 fails to disclose, or even suggest, that the ozonizer is configured to be stacked with another substantially similar ozonizer, as recited by claim 1 of the present invention. JP '501 discloses a round pipe (*see* ¶ 6) used for decontaminating water, food waste and human waste. There is no mention of the pipe being configured to be "stacked" with another substantially similar pipe. Further, because of its round shape, it would not be possible to "stack" a pipe such as the pipe disclosed by JP '501 without some additional support to prevent the pipes from rolling off of one another. However, JP '501 does not discuss or even suggest using additional support to stack multiple pipes.

Because JP '501 fails to disclose or suggest the claimed apparatus including "a dielectric spaced apart from [a] conductor . . . wherein said dielectric and said conductor are positioned to create a turbulent air flow therebetween, and said cell is configured for stacking with another substantially similar dielectric discharge plasma cell," claim 1 is allowable over JP '501. Claims 2, 4-10, 26-29 and 31-34 depend from claim 1 and are allowable for at least these reasons. Therefore, the Applicant respectfully requests that the Examiner withdraw the rejection of claims 1, 2, 4-10, 26-29 and 31-34.

II. Claim 3 Is Patentable Over JP '501 in Light of Liou in View of Birmingham

Claim 3 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over JP '501 in light of Liou in view of Birmingham. For the following reasons, this rejection is respectfully traversed.

As discussed above, because JP '501 fails to disclose or suggest the claimed apparatus including "a dielectric spaced apart from [a] conductor . . . wherein said dielectric and said conductor are positioned to create a turbulent air flow therebetween, and said cell is configured for stacking with another substantially similar dielectric discharge plasma cell," claim 1 is allowable over JP '501. Claim 3 depends from claim 1 and is allowable for at least these reasons. Therefore, the Applicant respectfully requests that the Examiner withdraw the rejection of claim 3.

III. Claims 4-10 and 13-25 Are Patentable Over JP '501 in Light of Liou in View of Racca

Claims 4-10 and 13-25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over JP '501 in light of Liou in view of Racca. For the following reasons, this rejection is respectfully traversed.

As discussed above, because JP '501 fails to disclose or suggest the claimed apparatus including "a dielectric spaced apart from [a] conductor . . . wherein said dielectric and said conductor are positioned to create a turbulent air flow therebetween, and said cell is configured for stacking with another substantially similar dielectric discharge plasma cell," claim 1 is allowable over JP '501. Claims 4-10 and 13-25 depend from claim 1 and are allowable for at least these reasons. Therefore, the Applicant respectfully requests that the Examiner withdraw the rejection of claims 4-10 and 13-25.

IV. Claims 11, 30 and 35 Are Patentable Over JP '501 in Light of Liou in View of Slipiec

Claims 11, 30 and 35 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over JP '501 in light of Liou in view of Slipiec. For the following reasons, this rejection is respectfully traversed.

Claim 35 recites “a dielectric spaced apart from [a] conductor . . . wherein said dielectric and said conductor are positioned to create a turbulent air flow therebetween.” As discussed above, JP ‘501 fails to disclose this recitation in claim 35. Slipiec fails to remedy this deficiency in JP ‘501.

Slipiec discloses an ozonizer similar in structure to the ozonizer disclosed by JP ‘501. The ozonizer disclosed by Slipiec includes three tubes 3, 3’, 3’’ (*see* FIG. 2) bundled together (using strap 31) in a cylindrical casing 5 (*see* col.4, ll.18-22). Each tube 3, 3’, 3’’ contains at least three pairs of electrodes separated by cylindrical tubes (*see* col.4, ll.22-26). The various electrodes in each tube are electrically interconnected with the electrodes in each of the other tubes (as shown in FIG.3).

Because of the similar structure of the ozonizers (tube/pipe) disclosed by JP ‘501 and Slipiec, Slipiec fails to disclose or even suggest turbulent air flow between a conductor and a dielectric for the same reasons discussed above with regard to JP ‘501. Further, Slipiec teaches away from the invention as recited by claim 35 because Slipiec states that one of the objectives of the invention is to provide “a minimum of interference of air flow therethrough.” (*see* col.2, ll.57-58) and that a laminar flow through the tubes is *desirable* (*see* col.2, ll.22-26).

Because both JP ‘501 and Slipiec fail to disclose or suggest the claimed apparatus including “a dielectric spaced apart from [a] conductor . . . wherein said dielectric and said conductor are positioned to create a turbulent air flow therebetween,” claim 35 is allowable over JP ‘501 in view of Slipiec. Therefore, the Applicant respectfully requests that the Examiner withdraw the rejection of claim 35.

Further, as discussed above, because JP ‘501 fails to disclose or suggest the claimed apparatus including “a dielectric spaced apart from [a] conductor . . . wherein said dielectric and said conductor are positioned to create a turbulent air flow therebetween,” claim 1 is allowable over JP ‘501. Claims 11 and 30 depend from claim 1 and are allowable for at least these reasons. Therefore, the Applicant respectfully requests that the Examiner withdraw the rejection of claims 11 and 30.

V. Claim 36 is Patentable Over JP '501 in Light of Liou in View of Gadow

Claim 36 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over JP '501 in light of Liou in view of Gadow. For the following reasons, this rejection is respectfully traversed.

Claim 36 recites “a dielectric spaced apart from [a] conductor . . . wherein said dielectric and said conductor are positioned to create a turbulent air flow therebetween.” As discussed above, JP '501 fails to disclose this recitation of claim 36. Gadow fails to remedy this deficiency in JP '501.

Gadow discloses an ozonizer with a similar structure to the invention disclosed by JP '501. However, Gadow discloses that the ozonizer may take the form of a pipe (as disclosed by JP '501) or two parallel plates having a narrow gap 118 through which gas is directed (*see* FIG. 2 and col.6, ll.65-67). The ozonizer disclosed by Gadow overcomes what are identified as problems with prior art ozonizers by providing an apparatus of small, compact size for creating plasma to decontaminate contaminated material (*see, e.g.,* col.1, ll.20-40).

Gadow fails to disclose or even fairly suggest that the flow of material between the two electrodes (in either form of the ozonizer) is turbulent. Gadow makes no mention of the flow of material between the electrodes other than the fact that material is “directed” through the discharge gap 18 (*see* col.6, ll.66-67).

Further, Gadow indicates that the invention's compact size is an improvement over prior art devices similar to JP '501 (*see* col.1, ll.50 to col.2, ll.45 and col.7, ll.55-57). Because of the compact size of the Gadow invention, the flow of material through the ozonizer (whether it be through a pipe or through parallel electrodes) is laminar due to the fact that the invention is directed towards decontaminating small amounts of material which are “directed” through the narrow opening in the apparatus. As discussed above, both the presence of pressure “forcing” the movement of the material through a narrow space and the lack of space within which the is able to move relative to the surface area to which the material may “attach” results in a laminar flow of material through the device.

Because JP '501 in view of Gadow fails to disclose or suggest the claimed apparatus including “a dielectric spaced apart from [a] conductor . . . wherein said dielectric and said conductor are positioned to create a turbulent air flow therebetween,” claim 36 is allowable over

JP '501 in view of Gadow. Therefore, the Applicant respectfully requests that the Examiner withdraw the rejection of claim 36.

Conclusion

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. The Applicant therefore respectfully requests that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicant believes that a full and complete response has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment is respectfully requested.

Respectfully submitted,


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